Patent Application

of

John E. Larson of P.O. Box 1197, Hamilton MT 59840

for

Height Adjustable Furniture Columns Including Actuation Mechanisms

BACKGROUND

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~~The present application is a continuation-in-part of co-pending U.S. Patent Application~~ serial number 09/173,236 filed 10/15/98 entitled "Height Adjustable Chairs and Tables" by the same inventor as the present application. That application is incorporated herein by this reference. The present application also claims the benefit under 35 U.S.C. 119E of U.S. Provisional Patent Applications serial number 60/091,800 filed 07/06/98 entitled "Height Adjustable Tables", and serial number 60/092,699 filed 07/14/98 entitled "Tube Release Mechanism for Gas or ~~Hydrometallic Springs" by the same inventor as the present application.~~

Height adjustable pedestals are commonly used in chairs in the work place. The height adjustable pedestals which are commonly used in chairs typically use telescoping gas spring mechanisms which assist the user in raising the chair seat to a desirable height. Additionally, the gas spring mechanisms provide a locking mechanism which, until actuated, will temporarily secure the vertical position of the chair seat. Accordingly, the expression "actuation" refers to the unlocking of the spring.

Gas springs typically comprise a cylinder, within which a pressurized gas and a gas valve are disposed. A piston is also disposed within the cylinder and is extendible from the cylinder due to the application of pressurized gas on the piston. The actuation of the gas spring involves opening the gas valve by depressing a valve actuation button which is at the top of the gas spring cylinder. Once the button is depressed or actuated, the pressurized gas within the gas spring cylinder is able to move internally within the cylinder through the valve. During the time the spring is actuated the spring is essentially unlocked. The pressurized gas in the actuated cylinder is allowed to pass through the internal valve and apply a downward force on a gas spring piston located within the gas spring cylinder. The distal end of the piston is typically secured proximate to the base of the chair and for this reason, the piston cannot move downwardly. Because of this, the downward force on the piston results in the application of an upward force on the gas spring cylinder. The gas spring cylinder is attached to the chair seat support mechanism. This upward force results in the raising of the chair seat. Similarly, this upward force needs to be overcome by the user to lower the chair seat. This typically involves the actuation of the spring mechanism and the application of a small amount of downward force on the chair seat until the chair seat is in the desired vertical position. At this point, actuation of the spring mechanism is ceased and the spring mechanism locks the vertical position.

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~~Height adjustment is increasingly seen as a desirable feature of tables as well. Height~~ adjustable pedestals using a single telescoping gas spring mechanism have ~~been~~ used in height adjustable tables that are typically of a type having a small ~~circular~~ table top. These height adjustable tables are designed as small meeting tables and are of limited use in the modern workplace. Specifically these height adjustable tables do not address the needs of computer users which desire a work desk which is at the proper height. These tables are not able to support the weight of computer equipment, nor are these tables designed to be used as a desk. The available height adjustable tables which use a single gas spring also do not address the needs of disabled ~~workers.~~

Due to perceived difficulties in using more than one telescoping spring mechanism in table pedestals, table manufacturers have typically used electric motors, hydraulics, or hand cranked mechanical lifting mechanisms in height adjustable tables. Tables using any of these three types of

lifting mechanisms have proven to be too expensive for widespread acceptance in the marketplace. Tables using hydraulic lifting mechanisms and motor actuated lifting mechanisms also have the disadvantage of extremely high weight which limits their use in modern dynamic work environments.

~~Electric motor use in height adjustable tables, although resulting in heavy and expensive~~ tables, does provide the benefit of allowing the ~~manufacturer~~ to place the switching mechanism at any location on ~~the table~~. This feature ensures that however the table is used that the switching ~~mechanism for activating the electric motor is properly position for ease of use.~~

Hydraulic lifting mechanisms and hand cranked mechanical lifting mechanisms do not provide flexibility in the placement of the actuation mechanism for the lifting mechanism. Hydraulic table bases require the use of a foot pump pedal at the base of the table proximate to a reservoir of oil. Tables using hand cranked mechanical lifting mechanisms typically require the hand crank lever to be placed on or near the table top where the crank lever may be an obstruction. Hand cranked mechanical lifting mechanisms are also extremely slow at making height adjustments.

As a result of the deficiencies noted for existing height adjustable tables and chairs, there is a need for height adjustable tables and chairs which use low cost technologies such as telescoping gas spring mechanisms. There is a need that these telescoping spring mechanisms may be incorporated into telescoping height adjustable columns that are useful in height adjustable pedestals or that may be used as individual telescoping legs. There is a need that these telescoping height adjustable columns use simple lever actuation mechanisms for height adjustment. There is a need that these telescoping height adjustable columns allow a variety of placement locations for lever actuation mechanisms. This would ensure that height adjustable chairs and tables using these telescoping height adjustable columns can accommodate the particular task performed on the chair or table. There is also a need for height adjustable chairs and tables that have high strength and low weight.

SUMMARY

The present invention relates to height adjustable columns which are typically for use in

height adjustable tables and chairs. The height adjustable columns of the present invention include telescoping spring mechanisms such as gas springs. The height adjustable columns of the present invention may be incorporated into a height adjustable pedestal for chairs or tables. Alternatively, the height adjustable columns may be used individually as chair or table legs in height adjustable table and chair assemblies.

Additionally, the present invention includes different versions of actuation mechanisms which are used to actuate telescoping spring mechanisms used in pedestals, chairs and tables. These actuation mechanisms are typically levers which are incorporated into the height adjustable columns. The actuation mechanisms increase the ease of performing height adjustments. The present invention also includes a particular column structure which may be used to support the actuation mechanisms and that maximizes the benefits provided by these actuation mechanisms. The column structure provides high strength characteristics that are beneficial if used in height adjustable pedestals for chairs or tables. The column structure is also suitable to be used as individual height adjustable legs for chairs or tables.

The actuation mechanisms and column structure of the present invention address the deficiencies of existing height adjustable chair pedestals which use a telescoping spring mechanism. These existing versions of actuation mechanisms typically position the actuation lever within the seat support mechanism of the chair. The seat support mechanism is also referred to as the chair control mechanism. Although this placement of the lever is typically used for most chair applications, this placement is not always the most desirable position or the most ergonomic position.

Chairs and tables constructed with the height adjustable columns of the present invention may include the actuation lever at a number of positions on the column or columns. These positions include locations on the column both above and below the chair or table base, or on the column proximate to the chair seat support or table top support.

The present invention also allows the actuation lever to be incorporated within the chair seat support or table top support. However, as the actuation lever does not need to be incorporated within the chair seat support or table top support, the chair seat supports and table top supports which are usable with the present invention do not need to be manufactured to

accommodate an actuation lever or a gas spring socket.

The freedom to position the actuation lever provided by the present invention allows for a chair or table to be constructed which is specialized for a particular usage.

An example where the present invention is valuable would be height adjustable stools that require height adjustments made by manipulating the actuation lever with the user's feet. In present stools, the actuation lever is either disposed on the chair seat support where only hand manipulation of the lever is possible, or below the stool base where foot manipulation is possible only when the stool seat is low enough for the user to reach the lever at this position immediately above the floor.

The present invention allows the lever to be placed above the base in a position where the feet can reach the lever regardless of the height of the stool seat. This is of particular importance to medical stools, and work stools used in a manufacturing setting where the user cannot contaminate their hands such as computer chip manufacturing. Users of drafting stools, and the disabled are also potential beneficiaries of this design.

The present invention also allows the actuation lever to be placed at a height where the lever could be manipulated by the users legs. This may be of particular importance in height adjustable tables where use of the hands is restricted.

The present invention includes tables that are supported by two or more telescoping gas spring cylinders. The actuation mechanisms which are disclosed allow for the simultaneous as well as non-simultaneous actuation of each of the gas springs used to support the table top.

The tables of the present invention include a table top, which may be of a variety of shapes. One version of the height adjustable table includes a table top supporting structure which includes two or more height adjustable legs or stanchions. Each of the legs or stanchions are typically placed underneath the table top at a position between the center of the table top and the side edges of the table top. Each leg or stanchion typically comprises a floor contacting base, a height adjustable column supported on the base, and a table top support supported on the height adjustable column. The height adjustable column of each leg or stanchion comprises at least one lockable telescoping spring assembly, such as a gas spring. The present invention further includes an actuation mechanism which can actuate or unlock each of the lockable telescoping springs

simultaneously.

The table or chair supporting structure in accordance with the present invention may also comprise four or more individual legs. As in the two legged table, each leg of the table or chair support would include a height adjustable column having a telescoping spring mechanism.

Telescoping spring mechanisms which use metal coil springs are also usable in this invention. These springs include oil filled cartridges which have an internal lockable valve and function similarly to the gas spring. An example of this type of spring is shown in U.S. Patent 5,078,351 which is incorporated herein by this reference.

DRAWINGS

FIG. 1 shows a perspective view of a portion of a first version of the height adjustable column used in the present invention.

FIG. 2 shows a perspective view of a portion of a second version of the height adjustable column used in the present invention.

FIG. 3 shows a perspective view of a portion of a third version of the height adjustable column used in the present invention.

FIG. 4A shows a perspective view of a version of a height adjustable table of the present invention.

FIG. 4B shows a perspective view of a version of a height adjustable table of the present invention.

FIG. 4C shows a perspective view of a version of a height adjustable table of the present invention.

FIG. 4D shows a perspective view of a version of a height adjustable table of the present invention.

FIG. 5 shows a side view of a version of a height adjustable stool of the present invention.

FIG. 6 shows a side view of a version of a height adjustable stool of the present invention.

FIG. 7 shows a side view of a version of a height adjustable stool of the present invention.

FIG. 8A shows a first side view of a version of a height adjustable column of the present invention.

FIG. 8B shows a second side view of the version of a height adjustable column of the present invention shown in FIG. 8A.

FIG. 8C shows a side view of a version of a height adjustable column of the present invention.

FIG. 9A shows a first side view of a version of a height adjustable column of the present invention.

~~FIG. 9B shows a second side view of a version of a height adjustable table of the present invention.~~

FIG. 9C shows a side view of a stand tube extension for use in the height adjustable column of FIGS. 9A and 9B.

FIG. 10 shows a perspective view of a portion of another version of the height adjustable column used in the present invention.

FIG. 11A and 11B show side views of a version of the height adjustable column of FIG. 10.

~~FIG. 12A show a side view of a height adjustable table.~~

FIG. 12B shows a side view of the height adjustable table of FIG. 12A.

DESCRIPTION

FIG. 1 shows a portion of a first version of the height adjustable column used in the present invention. FIG. 1 is also what is believed to be the simplest application of this version of the invention. This figure shows how a locking telescoping spring mechanisms 10 which is secured within a furniture component support 20 can be actuated, or unlocked, by a dual pivoting actuation lever 100 which in this example is disposed within the furniture component support.

In detail, the figure shows the top portion of a locking telescoping spring mechanism 10 which is disposed in a socket 22 of the furniture component support 20. This top portion of the locking telescoping spring mechanism would typically be the top of the cylinder portion of a gas spring. An actuation button 12 is disposed on the top of a locking telescoping spring mechanism which extends into the interior of the furniture component support 20. Should the locking telescoping spring mechanism 10 shown in the figure be a gas spring, then the actuation button 12

is an extension of a gas flow control valve which is disposed within the gas spring cylinder. If the locking telescoping spring mechanism includes a metal coil spring, then the actuation button is an extension of a fluid flow control valve which is typically disposed within a cartridge which is disposed within the cylinder of the mechanism and is surrounded by the metal coil. An example of this type of spring is shown in U.S. Patent 5,078,351 which is incorporated herein by this reference. Depressing the actuation button in either case results in the opening of an internal valve which allows the telescoping spring mechanism to either be compressed or allowed to extend. Specifically, the locking telescoping spring mechanism is actuated, or unlocked, when the actuation button is depressed.

A first elongated opening 24 is disposed in a first substantially upright wall 25 of the furniture component support 20. Similarly, a second elongated opening 26 is disposed in a second substantially upright wall 27 of the furniture component support. The upright walls 25 and 27 are disposed on opposite sides of the actuation button 12.

The actuation lever 100 is shown having three sections. A first lever section 102 is disposed outside the first upright wall 25. The first lever section includes a distal end 104, and a proximate end 106, relative to the first upright wall 25. A second actuation lever section 108 extends from the interior of the opening 24 of the first upright wall to the opening 26 of the second upright wall 27. The second actuation section 108 includes a first end 110 disposed within the opening 24 and a second end 112 disposed within the opening 26. The actuation lever second section 108 further includes a middle section 114 which is disposed immediately above the actuation button 112. An actuation lever third section 116 is disposed outside the second upright wall 27. The actuation lever third section includes a distal end 118 and a proximate end 120, relative to the second upright wall 27.

~~To actuate, or unlock, the telescoping spring mechanism either the actuation lever first or~~ third sections can be pivoted upward or downward. If the first lever section 102 is pivoted upward, the top surface 28 of the elongated opening 24 acts as a fulcrum. As the lever first section distal end 104 is moved upward, the actuation lever on the opposite side of the fulcrum 28 angles downward. This downward movement of the actuation lever second and third sections ~~results in the middle section 114 of the lever second section depressing the actuation button 112~~

and unlocking the ~~spring mechanism.~~

Pressing downward on the distal end 104 of the actuation lever first section results in the actuation lever pivoting about a fulcrum surface 30 disposed at the top of the second opening 26. This movement of the actuation lever first section also caused the middle section 114 of the lever second section to depress the actuation button. Again, while the actuation button is depressed, the entire mechanism is unlocked, and the spring within the mechanism may be compressed or allowed to resiliently expand.

The actuation lever third section 116 can be pivoted in the same manner as the first lever section. As the actuation lever is pivoting about the fulcrum surfaces at the top of the elongated openings, it is desirable to place the lever in contact with the fulcrum surfaces when the actuation mechanism is assembled within the furniture component support.

~~FIG. 2 shows how two retaining collars can be disposed on the actuation lever. The~~ retaining ~~collars are~~ one of many ways that the lever can be retained within the height adjustable ~~column~~.

FIG. 3 shows how a second actuation lever 130 which is disposed orthogonally to the first lever section, can be incorporated into the actuation mechanism of this version of the height adjustable column of the present invention. In this version of the invention, the second actuation lever 130 of the actuation mechanism is disposed in the same plane as the first lever 100. The second actuation lever 130 includes first, second and third lever sections 132, 134, and 136. The lever first section 132 is disposed outside of an elongated opening 32 formed in third substantially upright wall 33. The lever second section 134 is disposed from the inside of the opening 32 to the inside of the opening 34 disposed in a fourth substantially upright wall 35. The lever third section 136 is disposed outside the opening 34 of the fourth substantially upright wall 35.

The opening 32 includes a fulcrum surface 36. The opening 34, includes a fulcrum surface 38. The second actuation lever pivots about the fulcrum surfaces in exactly the same manner as was described for the first actuation lever 100. Again, it is desirable to place the lever in contact with the fulcrum surfaces when the actuation mechanism is assembled within the furniture component support. This ensures that the lever will pivot about the fulcrum surfaces and will not pivot about the actuation button.

FIG. 3 also shows a ring connector which connects the distal ends of the first and second actuation levers. The ring connector allows a user to actuate, or unlock, the telescoping spring mechanism by pivoting the ring upward or downward at any location on the ring. Regardless of the location on the ring which is moved upward or downward, the movement of the ring will result in the depressing of the actuation button.

In an exploded view, FIG. 4A shows how two height adjustable legs or stanchions, each of which include a height adjustable column, are able to support a table top. A first leg or stanchion for supporting the table top comprises a base section 402, a gas spring 406, a stand tube 408, and a table top support 414. The stand tube bottom 410 is shown tapered and is also shown exploded above a socket 404 of the base section within which the stand tube would be disposed. The top of the telescoping spring mechanism, which in this case is the cylinder of the mechanism, is shown extending from a top opening 409 within the stand tube 408. As was the case in FIGS. 1 through 3, the table top support includes a socket to receive the top of the cylinder of the telescoping spring mechanism.

An actuation lever 420 first section 421 is shown extending from an elongated opening 418 within a first substantially upright surface 416 of the table top support 414. An actuation lever third section 422 is shown extending out the opposite side of the table top support.

A second stanchion or leg which includes base 432, gas spring 436, stand tube 438, table top support 444, and actuation lever 450 is essentially identical to the first stanchion or leg.

The height adjustable table of FIG. 4A also shows connecting elements 454 and 456 which connect the distal ends of the actuation levers 420 and 450. In use, a height adjustment could be made by the user accessing the first connecting element 454 through the access holes 462 and 464 and either pressing upward or downward on the connecting rod 454. By pressing upward or downward on the connecting rod 454, the actuation levers 420 and 450 are both pivoted causing both actuation levers to contact the actuation buttons beneath each actuation lever to be depressed. This results in the actuation, or unlocking, of both of the telescoping spring mechanisms 406 and 436 simultaneously. Similarly, the user could access the second connecting member 456 through the access holes 466 and 468. The second connecting member could also be pressed upward or downward resulting in the simultaneous actuation of both of the telescoping

spring mechanisms 406 and 436.

It is understood that the actuation levers 420 and 450 and the connecting members 454 and 456 could be extended to the perimeter of the table. This would allow a user to maintain a secure hold on the edge of the table during height adjustments. This would also allow for the removal of the access holes 462 and 464, and 466 and 468 which may not meet the appearance requirements of some users.

~~Although the connecting members are beneficial in transferring the downward or upward lever movements, it is understood that the connecting elements could be removed which would require the user to actuate each locking telescoping spring mechanism independently. This is the version of the invention shown in FIG. 4C. Accordingly, the user would actuate the locking telescoping spring mechanisms by either pivoting the first or third lever section of each actuation lever upward or downward. It is also understood that an actuation mechanism such as was shown in FIG. 3 could be used with each leg or stanchion. Use of this double lever and ring actuation mechanism within a table having two legs would be similar to the description provided for FIG. 3 with the exception that both actuation mechanisms would need to be actuated to adjust the table top height. It is also possible to use the version of the invention shown in FIG. 4A in a table supporting structure having four independent legs, with each leg comprising a height adjustable column. An example of this would be to attach two additional levers to the connecting member 456 with the two additional levers extending in the opposite direction at the levers 420 and 450. These two additional levers would actuate two additional locking telescoping spring mechanisms of two additional legs which support the table. In a four legged table of this type the base sections could be removed, if desired. This is just one example of using the invention with more than two legs.~~

In an exploded view, FIG. 4B shows another version of the invention which includes two height adjustable legs or stanchions which support a table top. Each of the height adjustable legs or stanchions include a height adjustable column. In this version, the connecting member 456B has been moved closer to the table top supports 414B and 444B. Extending from the connecting member are knob extensions 474B and 475B (not shown). The knob extensions extend through holes 470B and 476B that are disposed within the table top. Knobs 472B and 478B are shown

exploded above the holes. The knobs are attached to the knob extensions.

In use the knobs provide a conveniently located surface on which the hands of the user will press to lower the table. The knobs also provide an ergonomic handle which the hands of the user can grab and lightly pull upwardly to cause the table to rise. The knobs are located close to the center of the table to minimize the application of a force which might cause the telescoping spring mechanisms to bind during height adjustments. Other placement for the knobs on the table are also possible, as well.

~~FIG. 4C shows how individually actuated locking telescoping spring mechanism can be~~ used in height adjustable columns used to support a table top. Each of the levers 420C and 450C would be accessed through the access holes. Both levers would have to both be pivoted to actuate the spring mechanisms, as no connecting member is provide to transfer the movement from one lever to the other as was the case in FIGS. 4A and 4B. A double lever or double lever ~~and ring actuation mechanism could also have been used as has been described earlier.~~

FIG. 4D shows the inclusion of structural connectors 480, 482 and 484 which may be used to add strength to the base, telescoping spring and stand tube assembly, and table support of the invention. These structural connectors may not be necessary in many instances, but should the need for higher strength arise, the invention will easily accommodate such requirements.

~~FIG. 5 shows another version of the invention. In this version, the double lever and ring~~ actuation are supported on a top tube of a height adjustable column. FIG. 5 is a side view of a height adjustable stool which includes a height adjustable column of the present invention. The version of the height adjustable column shown in FIG. 5 is different from that of the previous versions shown in FIGS. 1 through 4 in that top and bottom telescoping tubes are used within the height adjustable column. As will be seen, the use of telescoping tubes within the height adjustable column allows for a variety of actuation lever placement locations. The telescoping ~~tubes also provide a higher degree of strength to the column.~~

Specifically, FIG. 5 shows a height adjustable stool having a base 502 which includes a center socket 504. A locking telescoping spring mechanism, which includes a cylinder 506 and a piston 507, are supported by a stand tube 508. The stand tube 508 comprises the bottom telescoping tube of the column and includes a top opening 509 which provides a support surface

for the cylinder 506 which moves vertically within the opening 509. The stand tube also includes a tapered bottom end 510 which fits into the base center socket. A top tube 514 telescopes over the stand tube 508. The top tube 514 includes an internal support surface 516, which in this version includes a tapered socket sized to receive the tapered top portion of the telescoping spring cylinder.

~~The spring actuation button 512 extends within the interior of the top tube to a position above the support surface 516. The actuation mechanism is shown immediately above the actuation button. Part of the actuation mechanism is broken away to aid in viewing the interaction of the actuation mechanism of the actuation mechanism with the top tube and the actuation button. The actuation mechanism is similar to the mechanism which was previously shown and described in FIG. 3. The actuation mechanism includes a first lever that includes a first section 530, a second section 532, and a third section 534. A second lever which is orthogonally disposed relative to the first lever has been removed due to the cross sectioning of the invention within this drawing. A ring 536 is partially shown which connects the distal ends of the two orthogonally disposed levers.~~

The first actuation lever second section 532 is disposed within the interior of the top tube and is shown extending from the top of an elongated opening 522 within a first substantially upright surface within the upright cylindrical wall of the top tube 514, to the top of an elongated opening 524 within a second substantially upright surface within the upright cylindrical wall of the top tube 514. The second actuation lever which is not shown in this figure would extend between similar elongated openings within the cylindrical wall of the top tube.

The top of the elongated openings 522 and 524 form fulcrum surfaces on which the levers pivot as was previously described in FIGS. 1 through 3. The pivoting of the actuation mechanism, either upward or downward, results in the depressing of the actuation button 512 on the top of the locking telescoping spring mechanism. Once the actuation button is depressed the telescoping spring mechanism is unlocked. The spring, which is disposed within the cylinder of the mechanism, may be compressed or may be allowed to resiliently expand when in this actuated, or unlocked, condition. Compressing the spring results in the cylinder of the telescoping spring mechanism to telescope onto the piston. Resilient expansion of the spring results in the cylinder

telescoping away from the piston. Once a height adjustment is made the actuation mechanism is released and the internal valve within the spring mechanism will close, thus locking the mechanism in that position.

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~~A seat support plate 518 is supported by the top tube 514. A seat cushion 520 is similarly supported by the seat support plate 518. It is understood that many different types of seat support mechanisms, such as those incorporating tilt mechanisms, back rest mechanisms, etc., would be usable with stool. It is also understood that the seat cushion could be replaced with a table top.~~

FIG. 6 shows the height adjustable column of FIG. 5 in an inverted condition. The stand tube 608 is shown attached to the seat support plate 618. The bottom tube 614 is shown attached to the base 602 at the center socket 604 of the base. The telescoping spring support 616 in this version comprises a simple plate having a center opening through which the actuation button 612 extends.

An actuation lever is shown disposed within openings 622 and 624. The lever second section 632 contacts the bottom of elongated openings 622 and 624 ensuring that the lever will pivot on the fulcrum surfaces provided by the bottom surfaces of the elongated openings 622 and 624. The ring 636 has been partially broken out in the drawing so as to not prevent the drawing from showing the interaction of the actuation lever with the elongated openings and the actuation button. A second actuation lever orthogonally disposed relative to the first lever has been broken out from the drawing for the same purpose.

The actuation of the telescoping spring mechanism is identical to the actuation of the mechanism as was described for FIG. 5. However, with the placement of the actuation mechanism proximate to the chair base, the feet of the user would typically be used to manipulate the actuation ring.

FIG. 7 shows a version of the height adjustable column which is very similar to the column of FIG. 6. The bottom tube in this version extends completely through the base center socket. The elongated openings which are disposed in the bottom tube cylindrical wall, and through which the actuation levers extend, include a bottom surface which is formed by an end cap. The end cap supports the actuation levers within the elongated openings and provides the fulcrum surface at

the bottom of the elongated openings on which the levers pivot. As is shown in FIGS. 7a. 7b, and 7c, the end cap (717A, 717B, and 717C) can be attached to the bottom tube through the use of vertical or horizontal fasteners, or by welding the end cap to the bottom tube.

The use of the actuation mechanism of FIG. 7 is similar to the previous versions which use a ring actuation mechanism. It is understood that although the stools of FIGS. 5, 6, and 7 which are shown using a ring actuation mechanism, a single or double lever actuation mechanism as has also previously been described could also have been used.

FIG. 7 also show how a second actuation ring 764 can be supported by vertical members 760 and 762 and a horizontal member 766. This second actuation ring allows the user to actuate the telescoping spring mechanism for height adjustments when the seat is at the highest setting which results in the user being unable to contact the actuation ring 736.

FIGS. 8A and 8B show a height adjustable column that includes an actuation lever that uses a cam disposed on the lever. The cam is used to depress the actuation button of the locking telescoping spring mechanism.

The height adjustable column is supported on a base 802 which is shown partially broken away. The height adjustable column includes a locking telescoping spring mechanism which includes a cylinder 806, a piston 807 extending downward from the cylinder, and an actuation button 812. The locking telescoping spring mechanism is supported by a stand tube 808. The cylinder is movably supported within an opening 809 in the top of the stand tube. The stand tube is supported by a bottom tube 814. A top tube 815 telescopes over the bottom tube. The top tube includes a telescoping spring mechanism support surface 816 which has a center opening through which the actuation button extends. A table top or chair seat support plate 818 is supported on top of the top tube 815.

An actuation lever 830 is shown supported by the top tube. The actuation lever 830 includes a first handle section 832 and a second section 834. An eccentrically disposed cam lobe 836 is included on the center of the lever second section. The second section is shown supported at two positions on the cylindrical wall of the top tube 815 at the locations where the actuation lever passes through the cylindrical wall. Retaining collars 836 and 840 maintain the position of the cam lobe immediately above the actuation button 812.

Rotation of the lever first section 832 in either a clockwise or counter-clockwise direction results in the eccentric cam lobe 836 depressing the actuation button. FIG. 8B shows the eccentric cam lobe 836 from the side a side view. The lever is disposed immediately above the actuation button, and continuously contacts the actuation button throughout the rotation of the lever. The cam lobes depress the actuation button as the lever is rotated. Although the lever is shown supported at two positions on the cylindrical wall of the top tube 815, it is understood that the cam actuation lever as is shown if FIGS. 8A and 8B requires a single surface for support.

FIG. 8C shows a modified version of the height adjustable column of FIGS, 8A and 8B. The actuation lever 830C in FIG. 8C is shown extending between elongated openings 822C and 824C within the cylindrical wall of the top tube 815C. The actuation lever second section 834C is disposed such that the lever is contacting the top of the elongated openings 822C and 824C, while maintaining a position immediately above the actuation button 812C. Accordingly, the actuation lever can be either rotated in either direction or pivoted upward or downward. The top of the elongated openings provide a fulcrum surface as was the case in the previous versions of the invention. This placement at the top of the elongated openings 822C and 824C ensures that the actuation lever will pivot about the fulcrum surfaces and will not pivot about the actuation button. Although not shown, it is understood that the combination of a cam lobe and dual pivoting lever, as is shown in FIG. 8C, could have used in any of the previous versions if the invention. The inclusion of a cam lobe on the center section of the actuation levers would provide the actuation mechanisms the additional actuation mode of rotational actuation.

FIGS. 9A, 9B, and 9C are drawn to another version of a dual pivoting actuation mechanism for a height adjustable column. FIG. 9A shows a locking telescoping spring mechanism which comprises a cylinder 906, a piston 907 and an actuation button 912. The locking telescoping spring mechanism is supported by a stand tube 908. The cylinder is movably supported within an opening 909 at the top of the stand tube 908. An actuation lever 930 is shown extending through the upper portion of the cylinder. As FIG. 9B shows, actuation lever 930 is extends through elongated openings 922 and 924 that are disposed in the upper portion of the cylinder. The lever 930 is shown contacting a top fulcrum surface 923 of the opening 922 in FIG. 9B. The top of elongated openings 922 and 924 provide the fulcrum surfaces for the

pivoting actuation lever 930 which may be pivoted upward or downward. The lever second section will depress the actuation button 912 if the lever 930 is pivoted upward or downward.

FIG. 9C shows a stand tube extension which may be used to elevate the stand tube in height adjustable columns.

FIG. 10 shows a modified version of the actuation mechanism of FIG. 3. In this version, a first bottom actuation lever 1100 is overlapped by a second top actuation lever 1140 which is disposed immediately above the bottom lever. The bottom or first lever includes a first section 1102, a second section 1104, and a third section 1106. The bottom lever second section extends between elongated openings 1122 and 1126 which are disposed in a first wall section 1121 and a second wall section 1125 respectively. The bottom lever is disposed so the second section contacts the top fulcrum surfaces 1124 and 1128 of the elongated openings, while the lever contacts the actuation button.

The top or second actuation lever 1140 includes a first section 1142, a second section 1144, and a third section 1146. The top lever second section extends between elongated openings 1132 and 1136 which are disposed in third and fourth walls 1133 and 1135 respectively. The top lever is disposed so that the second section contacts the top fulcrum surfaces 1134 and 1138 of the elongated openings 1132 and 1136. The bottom of the top lever second section contacts the top of the bottom lever second section. The elongated openings 1132 and 1136 are disposed at an elevation above the elongated openings 1122 and 1126.

In use either of the lever can be pivoted upward or downward as was the case for the mechanism of FIG. 3. However, as the top or second lever is supported on the bottom or first lever, the pivoting of the top lever 1140 will result in the second section of the top lever pushing downward on the second section of the bottom lever. This causes the second section of the bottom lever to depress the actuation button 1112.

FIGS. 11A and 11B show how the two actuation lever second sections can be manufactured so that the levers engage each other in a specific manner that allows either lever to depress the actuation button if rotated. This rotational actuation is in addition to the dual pivoting actuation as was shown in FIG. 10. The engagement of the levers also provides a retention system for the levers and provides for easy assembly of the mechanism.

Sub A14

~~The bottom lever 1204 as is shown in FIG. 11A~~ includes a center portion 1245 from which a portion of the outside diameter of the lever has been removed. ~~Adjacent to~~ the center portion 1245 are cam lobes 1207 and 1209 which are of a larger diameter, and will depress the actuation button 1212 if the ~~lever is rotated clockwise or counter clock wise.~~

Sub A15

~~The bottom lever also includes a reduced diameter section on the top of the center portion 1211 for interaction with the top lever.~~

Sub A16

~~As is shown in FIG. 11B, the top lever also~~ includes a center portion ~~1245 of reduced~~ diameter which rests in ~~the recess 1211~~ of the first lever. Upon rotation of the second lever, one of ~~the~~ two cam lobes 1247 and 1249, which are adjacent to the center portion , will press downward on the first lever ~~and cause the first lever to depress the actuation button 1212.~~

FIGS. 12A and 12B show a four legged table where each leg comprises a height adjustable column. For simplicity, a single dual pivoting actuation lever is disposed on each height adjustable column. The levers are shown at 1202, 1204, 1206, and 1208. A perimeter connector 1210 connects the four levers. Two knobs 1212 and 1214 are attached to the perimeter connector. When both knobs are lifted, the perimeter connector is lifted which pivots the four levers and actuates the locking telescoping spring mechanism of each leg. This allows the table to be raised. Similarly, when both knobs are depressed, all four locking telescoping spring mechanisms are actuated and the table top can be lowered.

Additionally, a cable actuation mechanism is shown which includes four actuation cables 1220, 1222, 1224, and 1226, which are each attached to a single actuation lever. The actuation cables pass through housings 1221, 1223, 1225, and 1227 respectively. A handle 1228 is attached to each cable and will pull each cable equally, and simultaneously, thus actuation the locking telescoping spring mechanism of each leg.

It is understood that various modifications and changes in form or detail could readily be made without departing from the spirit of the invention. Many of such modifications have been previously mentioned within the description of the invention. It is therefore intended that the invention be not limited to the exact form and detail herein shown and described, nor to anything less than the whole of the invention herein disclosed and as hereinafter claimed.